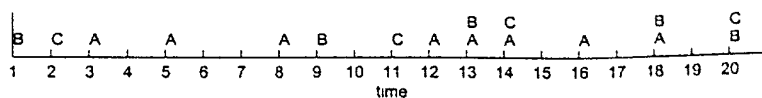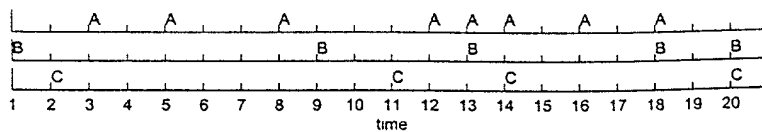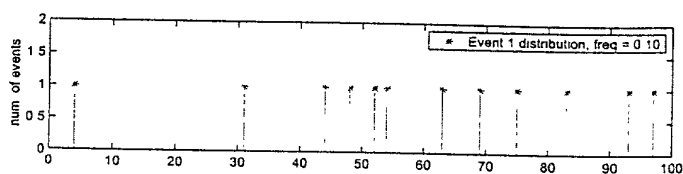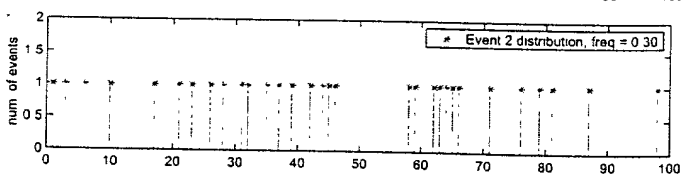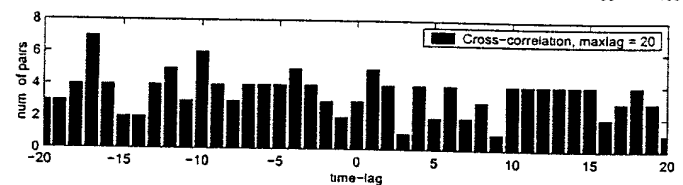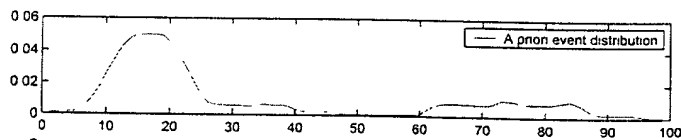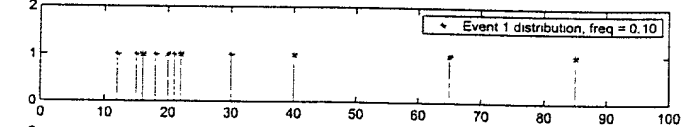Fig. 1

Fig. 2

Fig. 3A

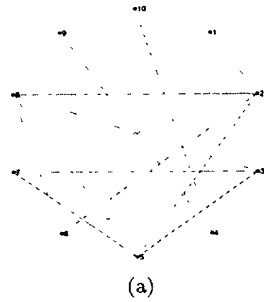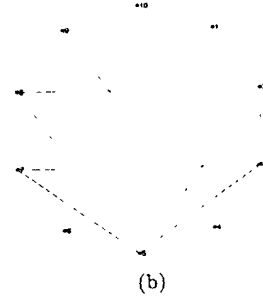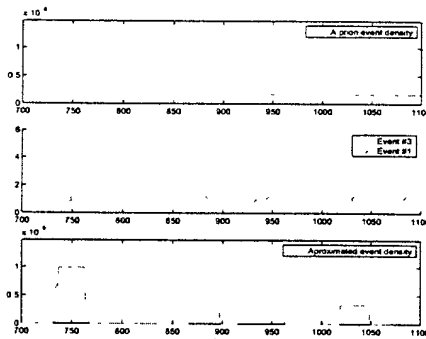Fig. 3B

Fig. 3C

Fig. 4A

Fig. 4B

Fig. 4C

Fig. 4D

Fig 5A

Fig. 5B

(a)
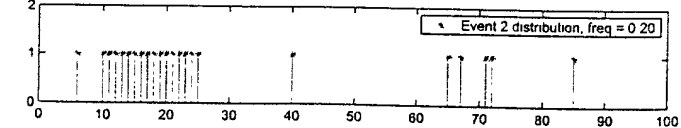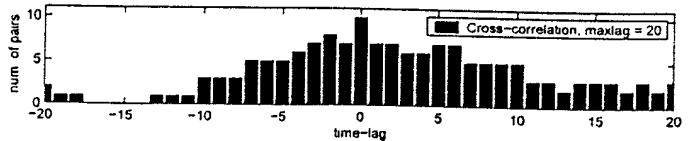
(b)
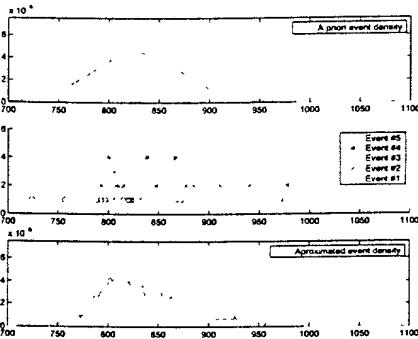
Fig. 6A1

Fig. 6B1

Fig. 6A2

Fig. 6B2

Fig. 6A3

Fig. 6B3

(a)

(b)

S=(<e1,t1>,…,<en,tn>) 1

2

S(ti,w)

3

Q

4

Map slices to vectors

5

S(ti,w)->r(ti,w)

6

Search in k-dimensions
(vectors)'

7

Q->q

8

S(tj,w),r(tj,w)

9

Verify
(slices)

10

S(tk,w)

Figure 7.

Figure 8

Random Variables r per
Event Type e per
Dimension j

j=1	$r_1(e_1)...r_1(e_t)$
.	.
.	.
.	.
j=k	$r_k(e_1)...r_k(e_t)$

~22

$es_1,ts_1,...,es_n,ts_n$ Observed Time Series
Events 1.. n

~21

Segmenter ~23

$d_{11},s_{11,..} d_{1m}s_{1m}$	...	$d_{h1},s_{h1,.} d_{hm}s_{hm}$	Event Segements 1 ..h

~24

Weighting Function Generator ~210

~25

Observed Event Vectorizer

j=1	For i=1...m Sum $(r_1(d_{1i})f(t-s_{1i}))$
.	.
.	.
.	.
j=k	For i=1...m Sum $(r_k(d_{1i})f(t-s_{1i}))$

...

j=1	For i=1...m Sum $(r_1(d_{hi})f(t-s_{hi}))$
.	.
.	.
.	.
j=k	For i=1...m Sum $(r_k(d_{hi})f(t-s_{hi}))$

~26

$Qe_1,. Qe_w$ Query Event Data
Slice

j=1	For i=1...w (Sum $(r_1(Qe_i)f(t-s_i))$)
.	.
.	.
.	.
j=k	For i=1...w (Sum $(r_k(dQe_wf(t-s_i))$)

~27

QueryEvent Vectorizer

Comparator ~28

Out

Verifier
(optional)

~29

Fig. 9

41

es₁,ts₁,...,esₙ,tsₙ

Observed Time Series
Events 1..n

42

Observed Event Data Preconditioner

Independent Event
Segements 1..h

43

Id₁₁,s₁₁,...Id₁ₘS₁ₘ	...	Id ₕ₁,Sₕ₁,..Id ₕₘSₕₘ

44

Dependent Event
Segements 1..h

Dd₁₁,s₁₁,...Dd₁ₘS₁ₘ	...	Dd ₕ₁,Sₕ₁, Dd ₕₘSₕₘ

25A

Observed Independent Event Vectorizer

25B

Observed Dependent Event Vectorizer

23A

28B

out

27A

Query Independent Event Vectorizer

27B

Query Dependent Event Vectorizer

Query Event Data Preconditioner

46

Query Data Segment

26

Fig. 9A

Observed Time Series
Events 1..n

9A41		9A66
es₁,ts₁,...,esₙ,tsₙ		Query Data Segment

$es_1,ts_1,...,es_n,ts_n$

9A42

Observed Event Data Preconditioner ⟷ Query Event Data Preconditioner

9A46

9A25

Observed Event Vectorizer

9A27

Query Independent Event Vectorizer

9A28

out
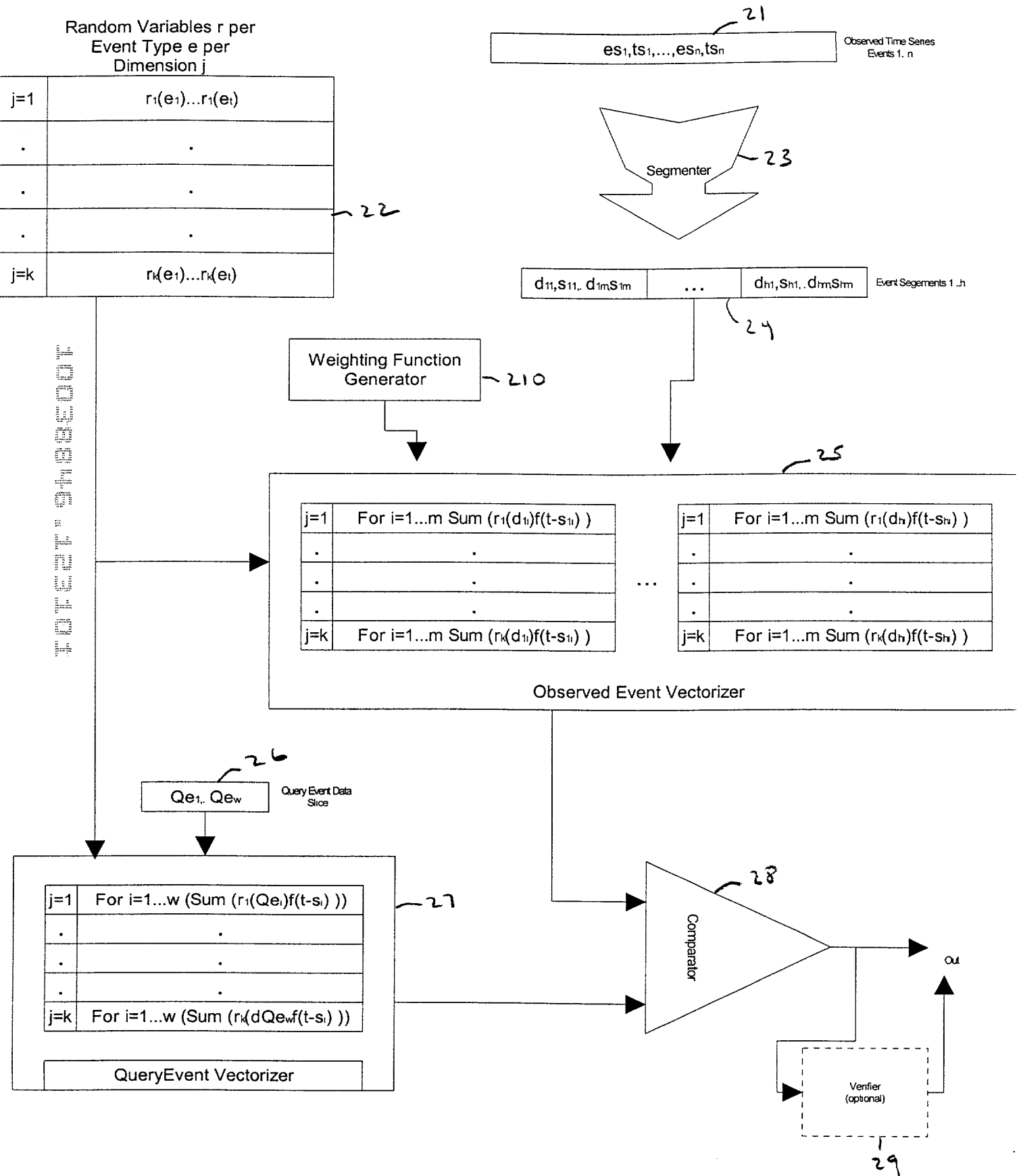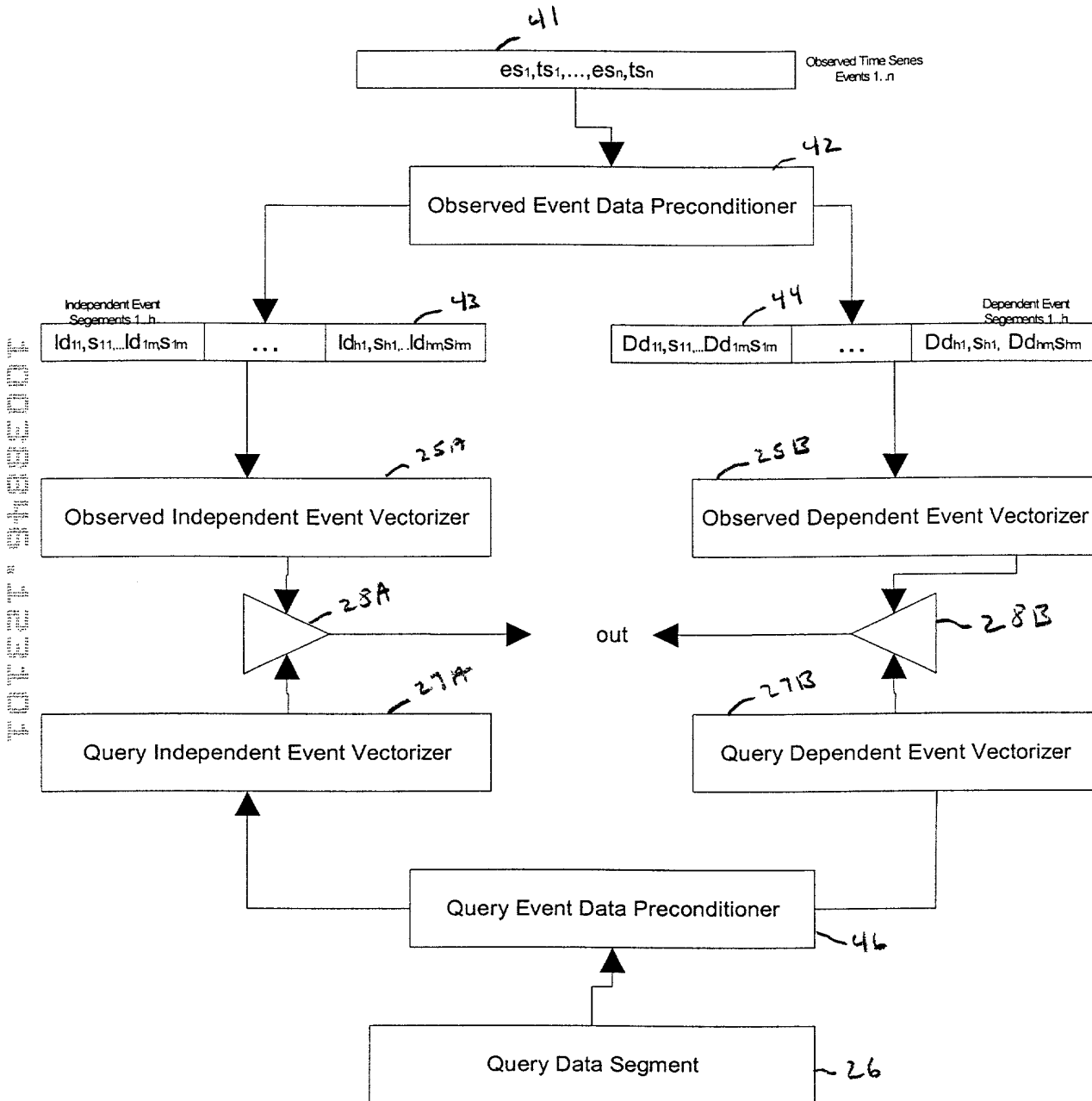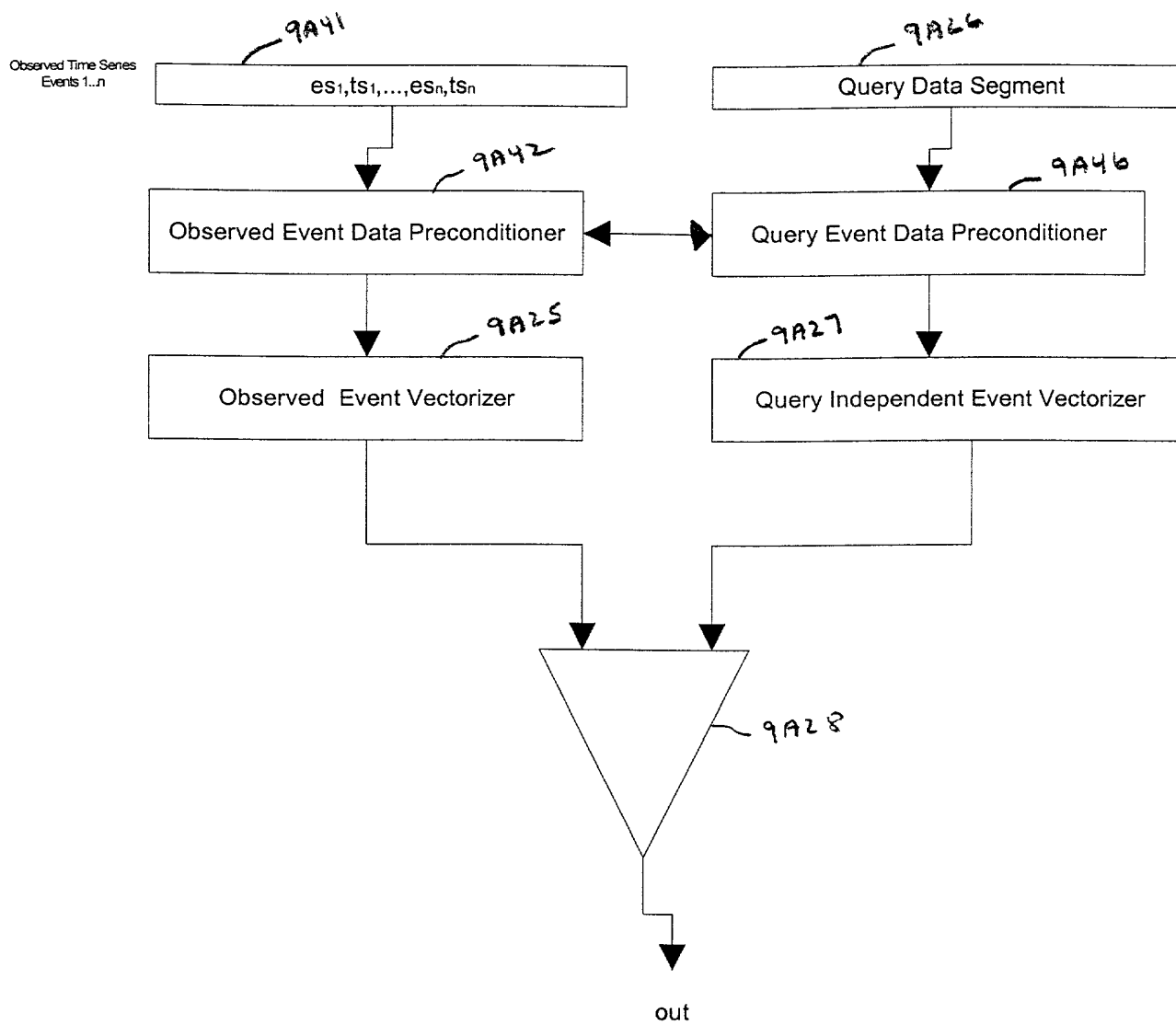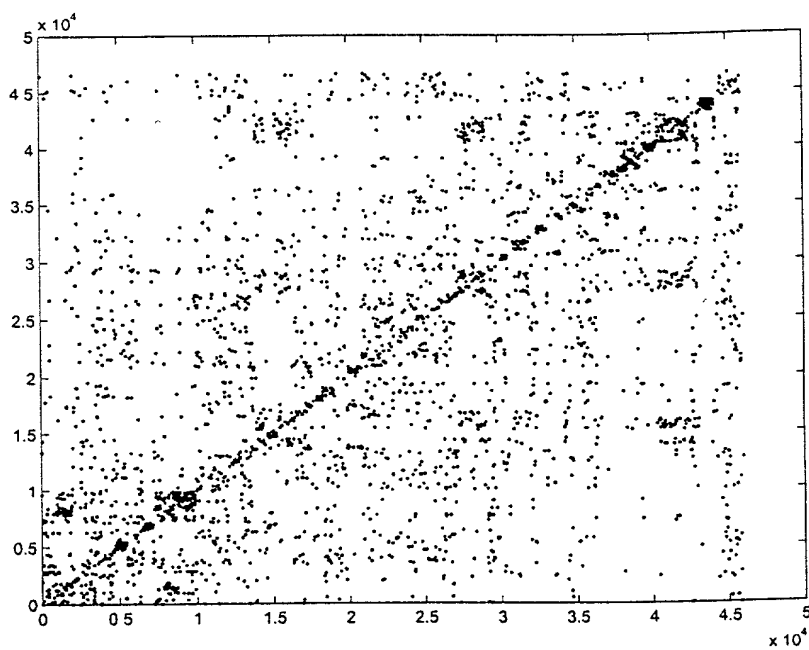
Fig. 10

The location of the closest slice to the query slice, for every 10th event in the sequence and for W=1000 sec.
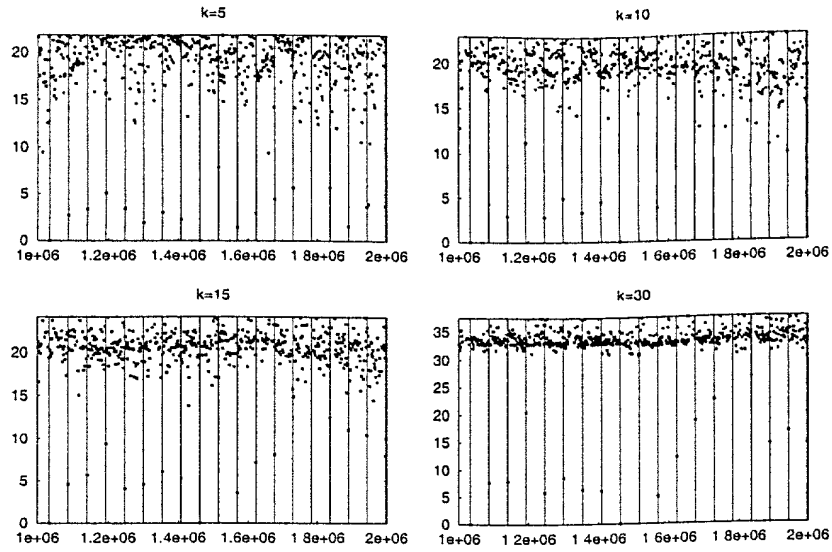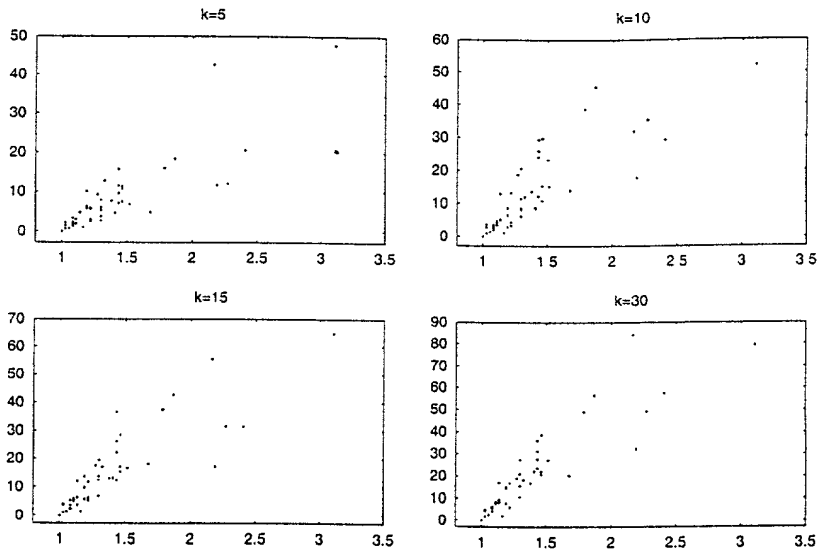
Fig. 11

k=5

k=10

k=15

k=30

Fig. 12

k=5

k=10

k=15

k=30

Distances of target windows against the density ratio, alarm data

Fig. 13

k=5

k=10

k=15
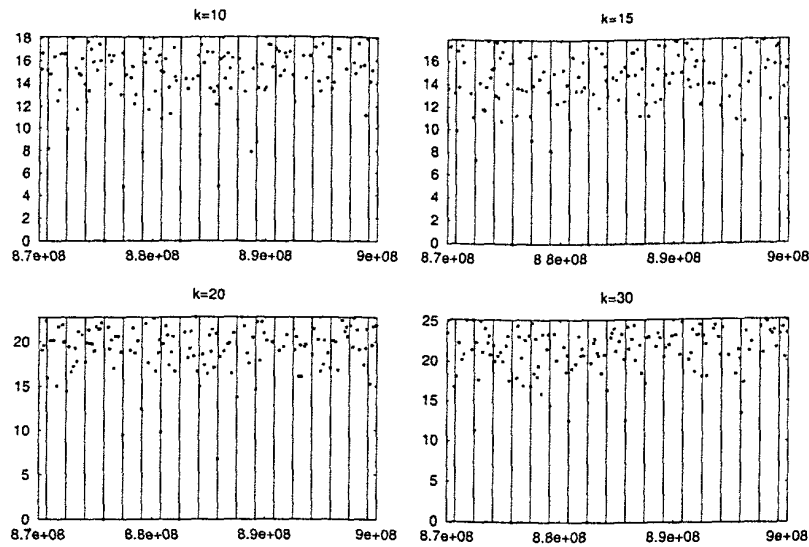
k=30
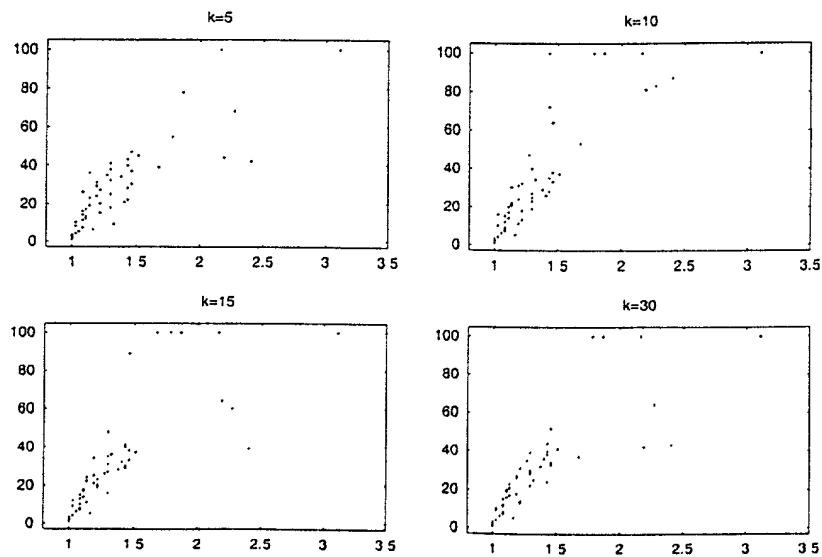
Fig. 14

Dist	Window	Closest	Offset	Dist	Window	Closest	Offset
0.00	1461230	1461230	exact	8.11	1675060	1675440	-380
0.00	2157420	2157420	exact	8.41	3014113	3014260	-147
0.00	1032800	1032800	exact	8.57	2799882	2800050	-168
1.02	2210970	2210970	exact	8.58	979102	979249	-147
1.26	497272	497272	exact	9.32	1193557	1193460	97
1.32	711484	711484	exact	10.18	818800	818590	210
2.10	872143	872143	exact	10.26	2639124	2639390	-266
2.59	3067820	3067820	exact	10.42	1942820	1943200	-380
3.55	1568330	1568330	exact	10.49	2853333	2853600	-267
3.61	2425180	2425180	exact	11.02	2478783	2478730	53
3.68	604378	604378	exact	11.02	1889383	1889650	-267
4.00	657931	657931	exact	11.33	2103614	2103860	-246
4.04	1247010	1247010	exact	12.17	2692793	2692940	-147
4.55	1300570	1300570	exact	12.41	1835763	1836100	-337
4.57	925696	925696	exact	12.91	2906893	2907160	-267
4.57	3121370	3121370	exact	13.14	2264140	2264520	-380
4.58	1086360	1086360	exact	13.75	3059438		missed
4.79	2532290	2532290	exact	13.77	1428734		missed
5.27	1407670	1407670	exact	14.08	2959387		missed
5.64	2371432	2371630	-198	14.17	755127		missed
5.70	1139910	1139910	exact	14.43	1961635		missed
5.82	2585840	2585840	exact	14.59	2053796		missed
6.13	1354120	1354120	exact	14.88	1729345	1728990	355
7.17	1621733	1621880	-147	15.01	1116290		missed
7.95	1996493	1996760	-267	15.26	2087183		missed

Dist=Distance to query window

Window=Position (time) of window found

Closest=Position of closest target window, if closer than 1000

Offset=Difference of this window and closest target

Distances of fifty closest selected windows, k = 15, alarm data
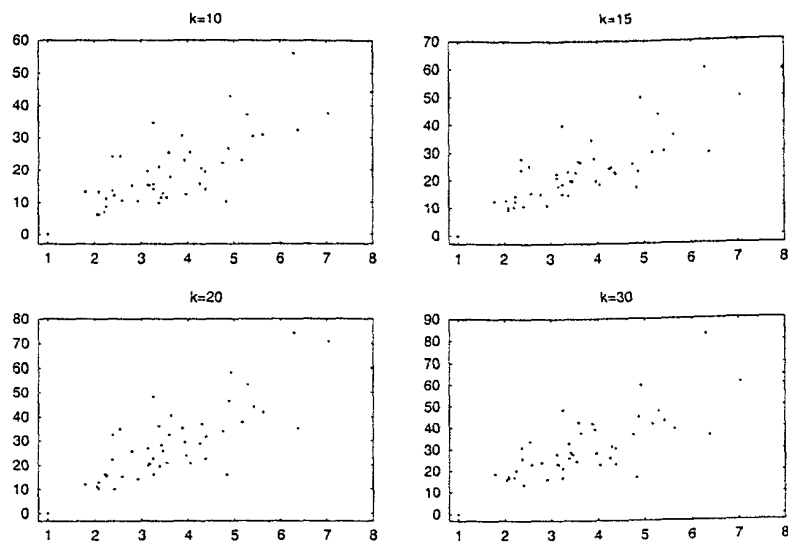
Fig. 17

Fig. 15

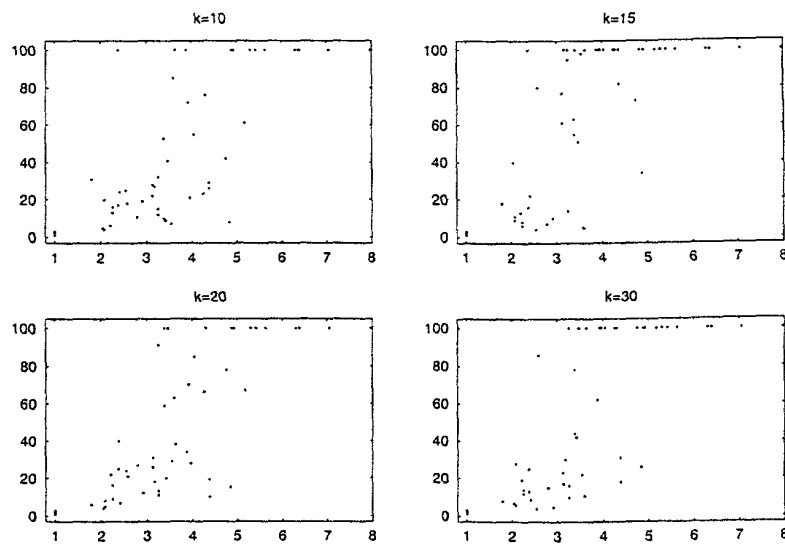*Distances of target windows against density ratio, Entree Chicago data*

Fig. 16

Ranks of target windows against the density ratio, Entree Chicago data